United States Department of Agriculture

Forest Service

North Central Forest Experiment Station

Resource Bulletin NC-169

Residential Fuelwood Consumption and Production in Kansas, 1994

Dennis M. May

North Central Forest Experiment Station
Forest Service—U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108
Manuscript approved for publication February 7, 1996
1996

CONTENTS

Consumption 1
Production 4
Appendix 5
  Study Methods 5
    Households 5
    Commercial Producers 6
  Sampling Error 6
  Study Limitations 6
  Definition of Terms 7
  Common and Scientific Names of Tree Species Mentioned 9
  Table Titles 10
  Tables 11

FOREWORD

This bulletin reports the results of a survey of residential fuelwood consumption and production in Kansas for a 1-year period encompassing the 1993/1994 heating season. Topics examined include the geographic distribution of residential fuelwood consumption and production within the State; the species of trees used for residential fuelwood; the types of wood-burning facilities used; the reasons for burning fuelwood; and the land, ownership, and tree classes from which fuelwood was produced. Such detailed information is necessary for intelligent planning and decisionmaking in wood procurement, forest resource management, forest industry development, and forest research.

Special thanks are given to the Kansas households and commercial producers who supplied information for this study. Their cooperation is greatly appreciated.

The Kansas State University Department of Horticulture, Forestry and Recreation Resources is acknowledged for its cooperation in conducting the survey, and special thanks are offered to the faculty, staff, and students involved for their diligence in phoning and questioning the survey respondents.

In this bulletin, consumption refers to the volume of fuelwood burned by Kansas' households, regardless of the source of the fuelwood (roundwood, wood residues from primary or secondary manufacturing, scrap or waste wood products, etc.). Production refers only to the volume of roundwood harvested to supply Kansas' wood-burning households. This report *does not* include information about harvesting for industrial fuelwood. Such information is included in reports covering wood use by primary processing plants.

Row and column data of tables may not sum due to rounding, but data in each table cell are accurately displayed.

Residential Fuelwood Consumption and Production in Kansas, 1994

Dennis M. May

CONSUMPTION

- Four out of 10 Kansas households had facilities to burn wood in 1994, but only 70 percent of them actually burned wood in that year (table 1).
- As a result, only about one in four households burned wood in 1994, but a higher proportion planned to burn wood in 1995.
- In 1994, more than 21,000 households planned to install wood-burning facilities. About three-fifths of the installations will be new; the rest will be replacement or supplemental units for households already engaged in wood burning.
- Most of the increased possession and use of wood-burning facilities was expected to occur in the Western and Northeastern Units of the State (table 1 and fig. 1).
- On average, each of Kansas' wood-burning households burned 1.4 cords of fuelwood in 1994, for a total consumption of about 368 thousand cords (table 2).
- In the two Survey Units with large metropolitan populations, the Northeastern and Western Units, pleasure was the most popular reason for burning wood; in the Southeastern Unit, burning wood as a secondary source of home heat was the primary reason.

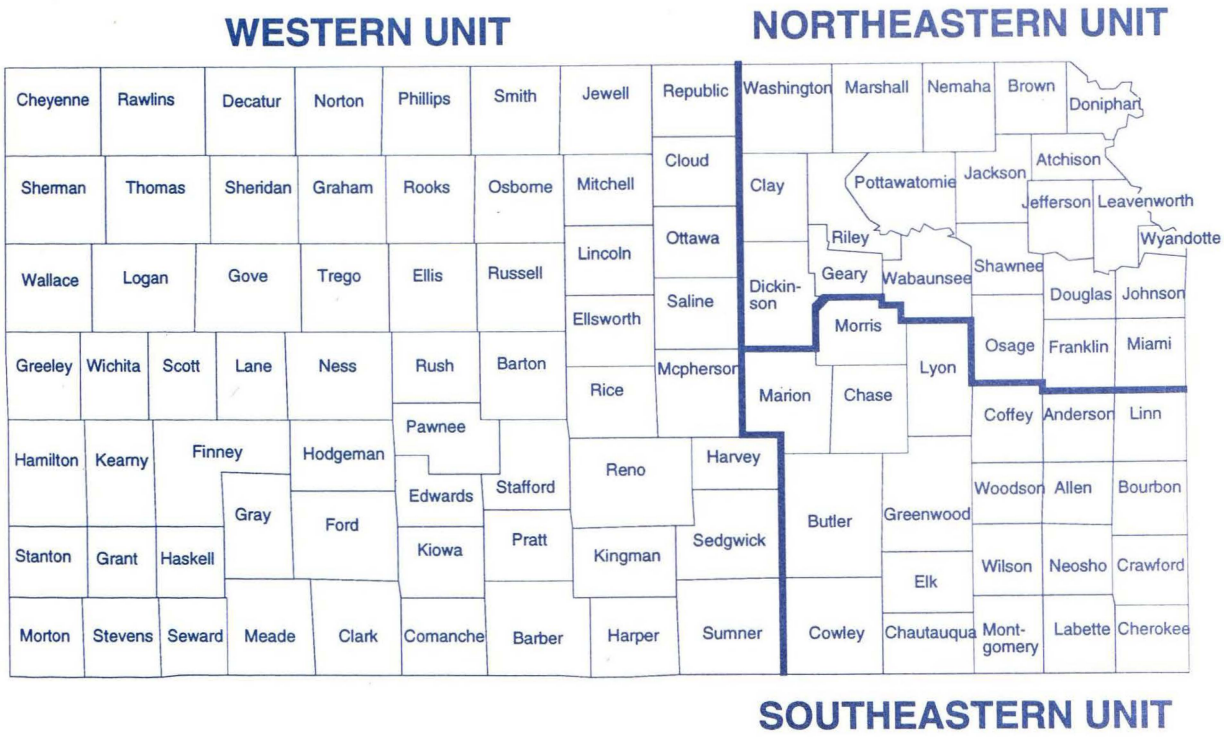

Figure 1.—*Forest Survey Units in Kansas, 1994.*

Dennis M. May, Research Forester, received a B.S. degree in forest management from the University of Maine and an M.S. degree in forest resources from the University of Idaho. He joined the USDA Forest Service in December 1983, and has been working with the North Central Station's Forest Inventory and Analysis Unit since May 1992.

- Overall, pleasure was the most popular reason for burning fuelwood in 1994.
- On average, households that burned wood for pleasure consumed about half a cord of fuelwood, only a fraction of the volume consumed by households that heated with wood.
- As a result, more fuelwood was consumed for home-heating purposes than for pleasure in 1994 (table 2 and fig. 2).
- Fireplaces were the most popular type of wood-burning facility used by Kansas households in 1994 (table 3). This was especially true in the Northeastern and Western Units where most households burned wood for pleasure, while wood stoves were most popular in the Southeastern Unit where most households burned wood as a secondary heat source.
- Three-fifths of households that burned wood in fireplaces did so for recreational purposes, while 90 percent of households that burned wood in wood stoves did so for home-heating purposes (table 4).
- As a result, more fuelwood was burned in wood stoves than in the more numerous fireplaces in 1994 (fig. 3).

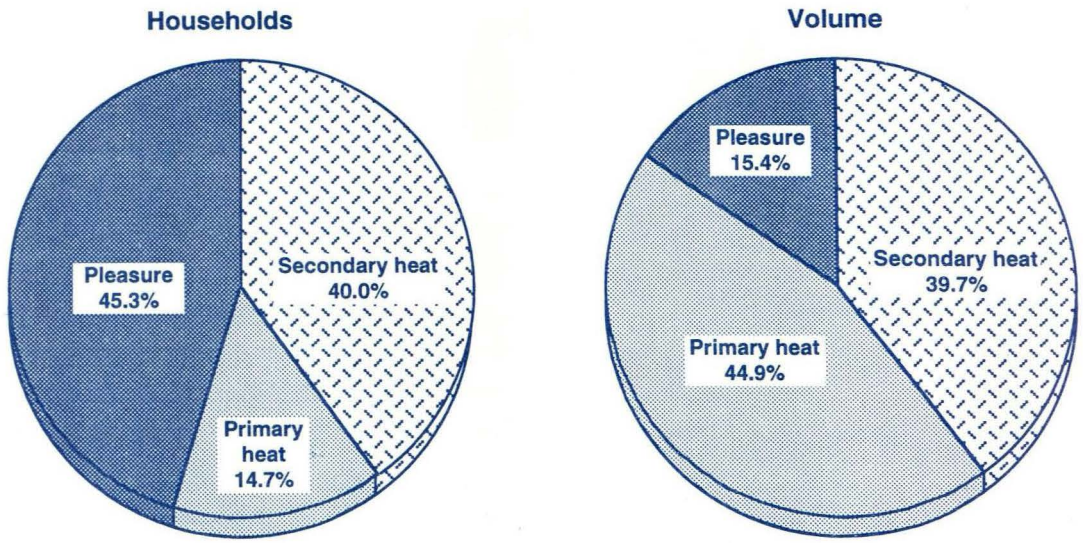

Figure 2.—*Distribution of residential fuelwood consumption by reason for burning, Kansas, 1994.*

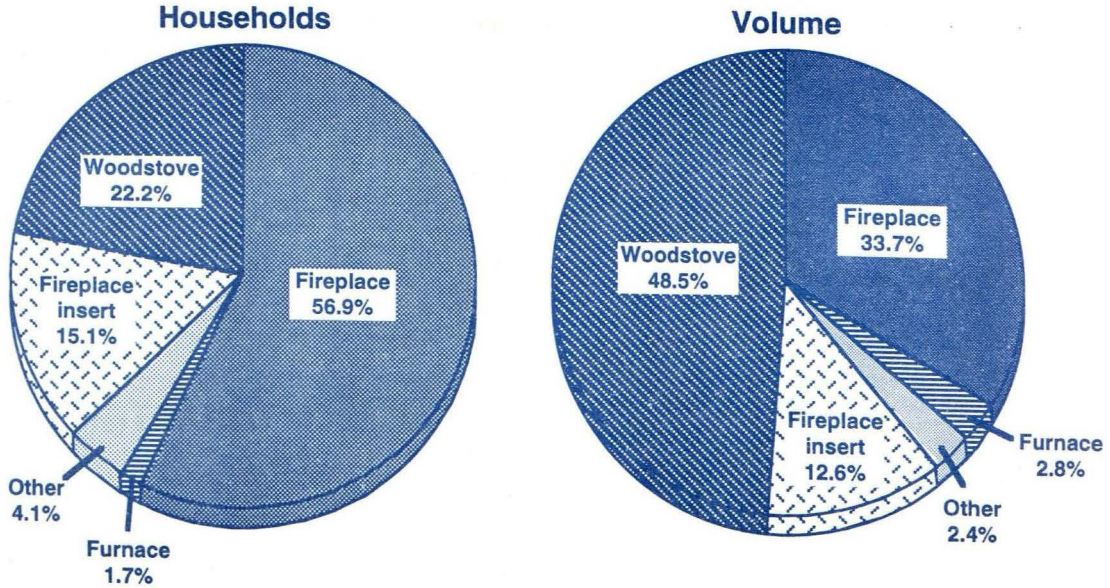

Figure 3.—*Distribution of residential fuelwood consumption by wood-burning facility, Kansas, 1994.*

- In 1994, two-thirds of Kansas' wood burners had burned wood for at least 5 years (table 5).
- These veteran wood burners were more likely to burn wood as a primary heat source (fig. 4), and consequently burned three-quarters of all fuelwood consumed in 1994.
- Almost all of the fuelwood burned in 1994 was consumed at primary residences (table 6).
- Almost all of the fuelwood burned came from roundwood, but about 6 percent of the households relied on wood residues for all or part of their fuelwood needs in 1994 (table 7).
- Three main species—oak, Osage-orange, and elm—accounted for three-quarters of all volume burned; oak alone accounted for two-fifths of the total (table 8).
- Osage-orange was the leading species burned in the Southeastern Unit, and cottonwood was one of the most preferred species in the Western Unit.

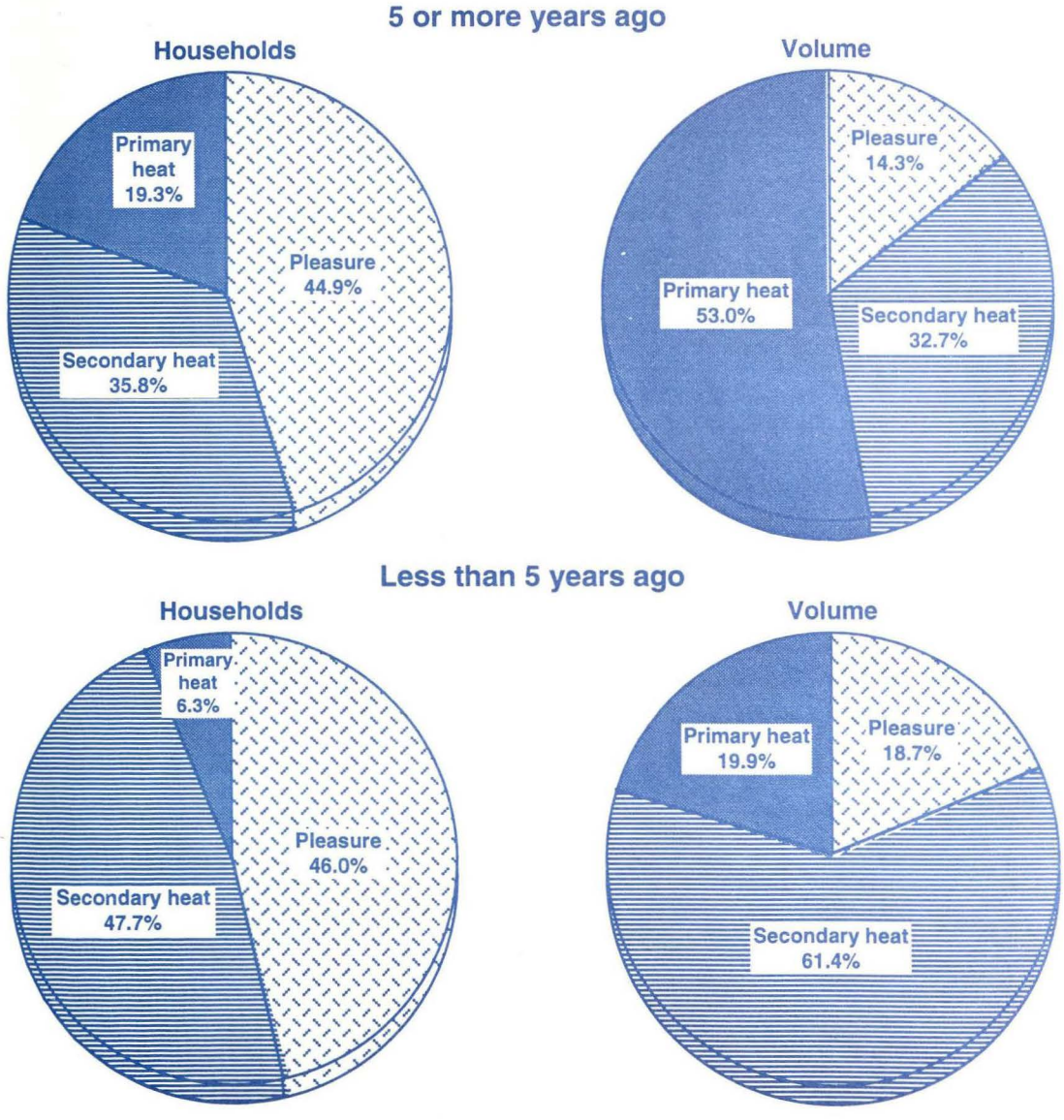

Figure 4.—*Distribution of residential fuelwood consumption by reason for burning and year first burned wood, Kansas, 1994.*

- Half of Kansas' wood-burning households cut all or part of the fuelwood they burned in 1994 (table 9).
- In total, 54 percent of the volume burned in 1994 was cut by residents of wood-burning households. Most of the remaining volume, two-fifths of the total consumption, was purchased (fig. 5).

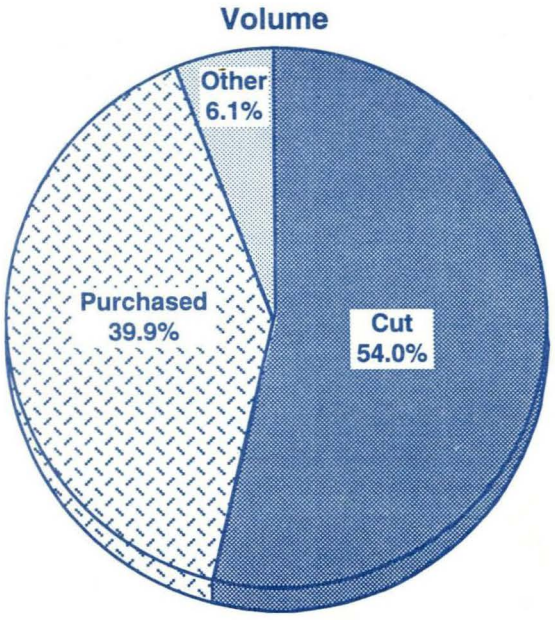

Figure 5.—*Distribution of residential fuelwood consumption by method of procurement, Kansas, 1994.*

- Purchased wood was most frequently delivered in cords of stove-length wood, commonly referred to as face cords or ricks (table 10). Sixteen-inch wood was most common, but 24-inch wood was also popular.
- On average, households that purchased fuelwood burned just over a cord of purchased wood each in 1994.

PRODUCTION

- In 1994, 329 thousand cords of roundwood fuelwood were cut in Kansas to meet the State's residential fuelwood demands (table 11).
- About two-fifths of this volume was produced from forest land sources, mostly dead trees. The remainder was cut from a variety of nonforest land sources, mainly pastures and cropland (fig. 6).
- Four species—Osage-orange, oak, elm, and cottonwood—accounted for four-fifths of the fuelwood cut (table 12).

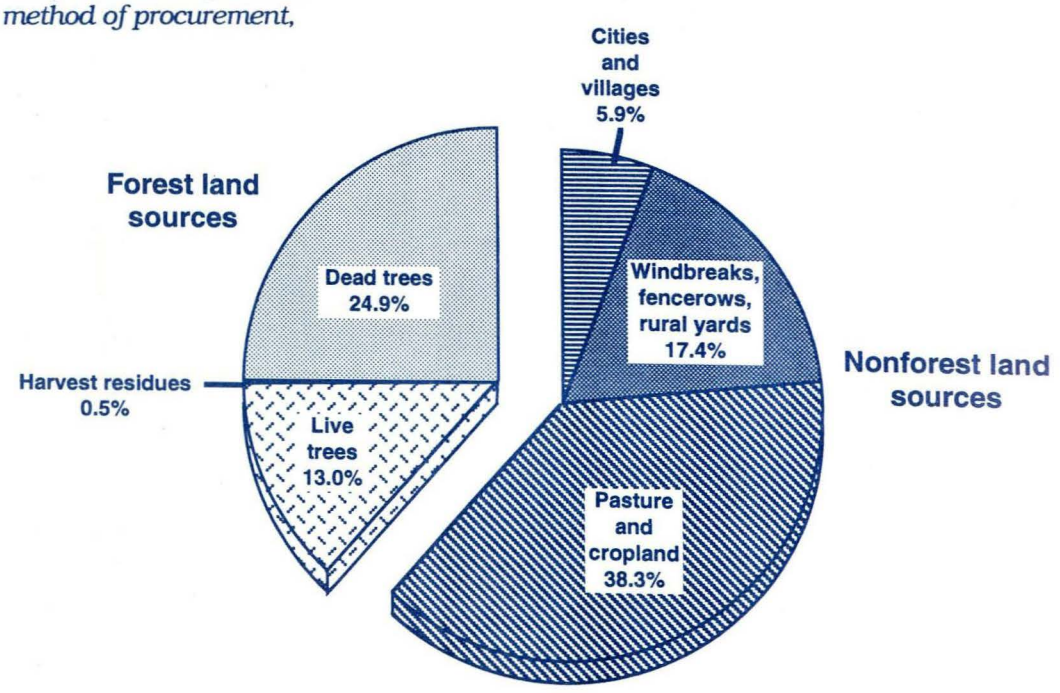

Figure 6.—*Distribution of residential fuelwood production by source of material, Kansas, 1994.*

- Osage-orange was the preferred species in the two eastern Units, while cottonwood was the preferred species in the Western Unit (table 13).
- Private lands supplied essentially all of the fuelwood harvested (tables 14, 15).
- In 1994, only 4 percent of all fuelwood produced was cut from growing-stock portions of live timberland trees (tables 16, 17 and fig. 7). As a consequence, fuelwood removals had very little impact on the growing-stock inventory of Kansas, the traditional supply source of the State's primary wood-using industry.

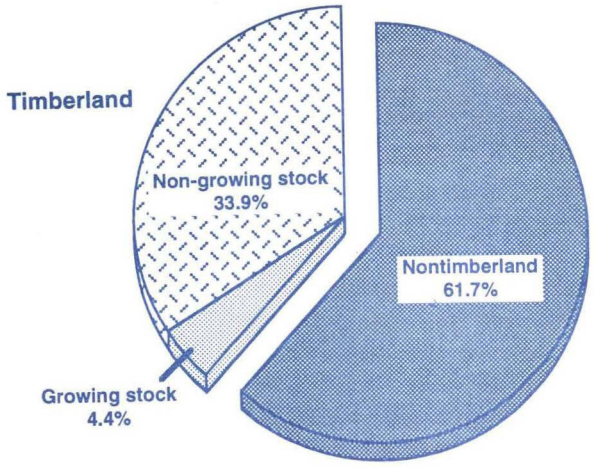

Figure 7.—*Distribution of timber removals associated with residential fuelwood production, Kansas, 1994.*

APPENDIX

STUDY METHODS

Data for this publication were collected by a telephone survey conducted during September 1994 by the Department of Horticulture, Forestry and Recreation Resources at Kansas State University. The telephone survey sampled Kansas households and canvassed all known commercial producers, using formal questionnaires prepared by the North Central Forest Experiment Station and approved by the Federal Office of Management and Budget.

Households

The sampled universe encompassed all households in Kansas with telephones. A total sample size of 900 households was selected based on funding available and a desired standard error of less than ± 20 percent statewide at one standard deviation. The State was stratified into two sampling strata (urban and rural) based on population densities within counties (fig. 8).

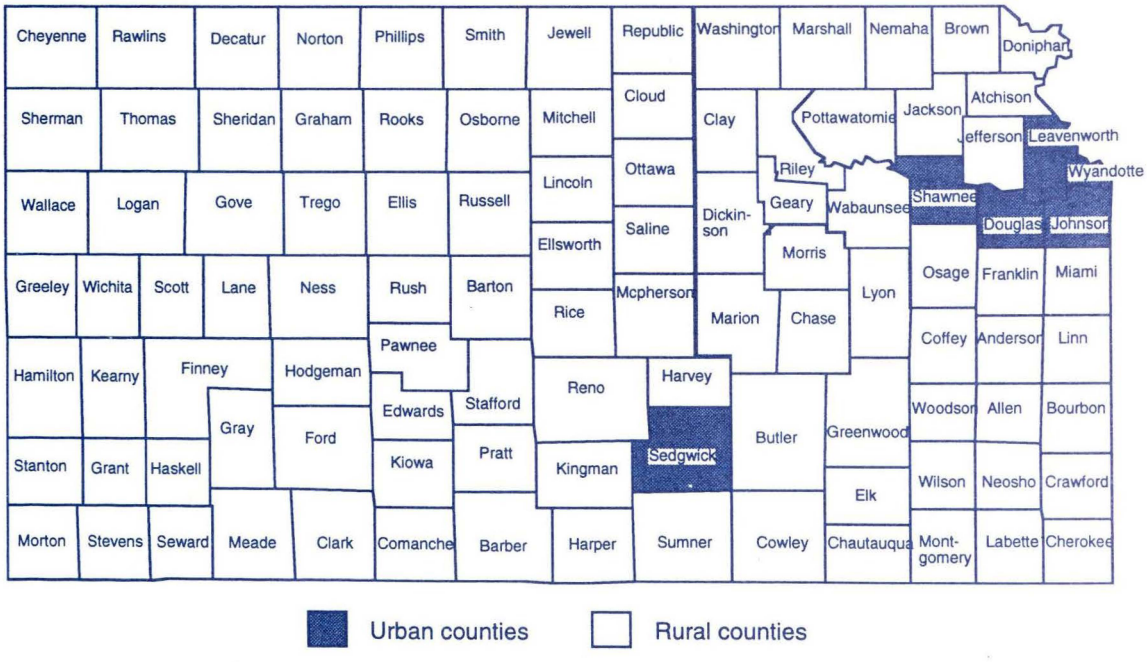

Figure 8.—*Sampling strata in Kansas.*

The total number of samples was disproportionally allocated to each stratum based on the number of households and the expected variation in fuelwood production in each stratum. The strata samples were proportionally distributed across the counties in each stratum based on the number of households in each county. The county samples were evenly distributed across the three-digit telephone exchanges in each county. A random list of telephone numbers was generated for each county using all listed three-digit phone exchanges. One call was placed (whether successful or unsuccessful) to each of the random telephone numbers until the necessary number of residential households within each exchange and county was contacted. In the urban stratum about 1 in 2,071 households were sampled; in the rural stratum about 1 in 711 households were sampled. Stratum sample responses were expanded to population estimates of total fuelwood use based on these sample rates.

Commercial Producers

A list of commercial fuelwood producers was compiled from advertisements for firewood sales discovered in a one time search of all Kansas newspapers and telephone directory yellow pages. A total of 200 commercial producers were found. All of these commercial producers were canvassed about their production of residential fuelwood, using a formal questionnaire similar to that used for households. Possible duplicate sampling of commercial producers was minimized by cross checking telephone numbers of all sample households producing more than 20 cords of fuelwood against the commercial producers list.

Completed questionnaires were sent to the North Central Forest Experiment Station for editing and processing. Some respondents did not know the tree species cut or burned for fuel, except in general terms such as mixed hardwoods. As part of the processing, general species groupings were prorated to individual species specifically identified as being harvested or burned in a sampling stratum and Forest Survey Unit.

SAMPLING ERROR

All the reported figures are estimates based on sampling procedures that are designed to give accurate estimates of residential fuelwood consumption and production. A measure of reliability of these figures is given by sampling errors. This sampling error means that the chances are two out of three that the results for the sample differ by no more than the amount indicated from the results that would have been obtained if a complete census of all households and commercial producers had been made. Sampling errors for estimates of residential fuelwood consumption and production in Kansas are shown below:

Stratum	Consumption (Cords)	Error (Percent)	Production (Cords)	Error (Percent)
Urban residential	175,959	24.8	117,655	48.1
Rural residential	191,898	15.2	207,720	15.5
Residential households	367,857	14.2	325,376	20.0
Commercial producers	—	—	3,180	—
State total	367,857	14.2	328,556	19.8

STUDY LIMITATIONS

This study reports both the consumption and production of residential fuelwood in Kansas for a 1-year period ending at the time of the telephone survey, essentially encompassing the 1993/1994 burning season, but dated 1994 for reporting purposes. Consumption refers to the volume of fuelwood burned by Kansas' wood-burning households, regardless of the source of the fuelwood (roundwood, wood residues from primary or secondary manufacturing, scrap or waste wood products, etc.). Production, on the other hand, refers only to the volume of roundwood harvested to supply the State's wood-burning households. Due to these definition differences, as well as seasoning time, leftover fuelwood inventories from previous years, gift or free wood, cross-State wood movement, fluctuating participation in wood burning, and use of wood residues and wood wastes, estimates of fuelwood production and consumption should not be expected to match in a given year.

Additionally, production does not include fuelwood produced from wood residues generated at primary wood-using mills (such as sawmills and cooperage mills), fuelwood produced from roundwood for industrial consumption, fuelwood produced from wood residues generated at secondary wood-using mills (such as millwork plants and furniture plants), or fuelwood produced from waste wood products.

However, fuelwood produced from primary mill residues and fuelwood produced for industrial consumption are captured in other studies. And although fuelwood production from secondary mill residues and waste secondary wood products is beyond the scope of Forest Inventory and Analysis duties, part of this volume is captured in the consumption portion of the residential fuelwood studies.

Households without telephones were not sampled. To compensate for this omission, sample responses from households with phones were assumed representative of the relatively small number of households without phones, and were expanded across all existing households in Kansas. Study results may be slightly biased if fuelwood consumption or production per household differs significantly in quantity or sources between phoneless households and households with phones.

Some commercial producers may not advertise in newspapers or the yellow pages, or may not have been advertising when the commercial producers list was compiled. Consequently, some commercial producers may have been excluded from the study, which would result in a conservative estimate of fuelwood production.

To assess the impacts of fuelwood harvesting on the State's forest inventory from the telephone survey responses, reported fuelwood harvests from "woodland areas outside of city or village limits" were assumed to be the same as forest land harvests, and all forest land harvests were assumed to be timberland harvests.

DEFINITION OF TERMS

Central stem.—The portion of a tree between a 1-foot stump and the minimum 4.0-inch top diameter outside bark or the point where the central stem breaks into limbs.

Commercial producers.—Commercial fuelwood operators. Those who harvest fuelwood to sell to dealers or consumers. Includes loggers who harvest fuelwood along with saw logs and other products.

Commercial species.—Tree species presently or prospectively suitable for industrial wood products. (Note: Excludes species of typically small size, poor form, or inferior quality such as hophornbeam, Osage-orange, and redbud.)

Cord (standard fuelwood).—A pile of logs 4x4x8 feet (128 cubic feet including air space and bark). A standard cord of fuelwood contains 70 cubic feet of wood and 58 cubic feet of bark and air space.

Cull removals.—Net volume of rough and rotten trees, plus the net volume in sections of the central stem of growing-stock trees that do not meet regional merchantability standards, harvested for roundwood products.

Dead removals.—Net volume of dead trees harvested for roundwood products.

Diameter at breast height (d.b.h.).—The outside bark diameter at 4.5 feet above the forest floor on the uphill side of the tree. For determining breast height, the forest floor includes the duff layer that may be present, but does not include unincorporated woody debris that may rise above the ground line.

Face cord.—A stack of stove-length wood (most commonly 16 inches wide) that is 4 feet high and 8 feet long, locally referred to as a "rick."

Forest land.—Land at least 16.7 percent stocked by forest trees of any size, or formerly having had such tree cover, and not currently developed for nonforest use. (Note: Stocking is measured by comparing specified standards with basal area and/or number of trees, age or size, and spacing.) The minimum area for classification of forest land is 1 acre. Roadside, streamside, and shelterbelt strips of timber must have a crown width of at least 120 feet to qualify as forest land. Unimproved roads and trails, streams, or other bodies of water or clearings in forest areas shall be classed as forest if less than 120 feet wide.

Fuelwood consumption.—The fuelwood burned by residential households.

Fuelwood production.—The volume of roundwood harvested to supply residential households.

Growing-stock removals.—The growing-stock volume removed from the timberland inventory by harvesting roundwood products. (Note: Includes sawtimber removals, poletimber removals, and logging residues.)

Growing-stock tree.—A live timberland tree of commercial species that meets specified standards of size, quality, and merchantability. (Note: Excludes rough, rotten, and dead trees.)

Growing-stock volume.—Net volume of growing-stock trees 5.0 inches d.b.h. and over, from 1 foot above the ground to a minimum 4.0-inch top diameter outside bark of the central stem or to the point where the central stem breaks into limbs.

Hardwoods.—Dicotyledonous trees, usually broad-leaved and deciduous.

Harvest residues.—The total net volume of unused portions of trees cut or killed by logging. (Note: Includes both logging residues and logging slash.)

Limbwood removals.—Net volume of all portions of a tree other than the central stem, (including forks, large limbs, tops, and stumps) harvested for roundwood products.

Logging residue.—The net volume of unused portions of the merchantable central stem of growing-stock trees cut or killed by logging.

Logging slash.—The net volume of unused portions of the unmerchantable (non-growing-stock) sections of trees cut or killed by logging.

Merchantable sections.—Sections of the central stem of growing-stock trees that meet either pulpwood or saw-log specifications.

Net volume.—Gross volume less deductions for rot, sweep, or other defects affecting use for roundwood products.

Noncommercial species.—Tree species of typically small size, poor form, or inferior quality that normally do not develop into trees suitable for industrial roundwood products.

Nonforest land.—Land that has never supported forests, and land formerly forested where use for timber management is precluded by development for other uses. (Note: Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining clearings, powerline clearings of any width, and 1- to 39.9-acre areas of water classified by the Bureau of the Census as land. If intermingled in forest areas, improved roads and nonforest strips must be more than 120 feet wide and more than 1 acre to qualify as nonforest land.)

Nonforest land removals.—Net volume of trees on nonforest lands harvested for roundwood products.

Nontimberland.—The same as nonforest land in this report.

Poletimber.—A growing-stock tree at least 5.0 inches d.b.h. but smaller than sawtimber size (9.0 inches d.b.h. for softwoods, 11.0 inches d.b.h. for hardwoods).

Poletimber removals.—Net volume in the merchantable central stem of poletimber trees harvested for roundwood products.

Primary wood-using mills.—Mills receiving roundwood or chips from roundwood for processing into primary products (lumber, plywood, etc.).

Rotten tree.—A tree that does not meet regional merchantability standards because of excessive unsound cull.

Rough tree.—A tree that does not meet regional merchantability standards because of excessive sound cull. Includes noncommercial tree species.

Roundwood.—Logs, bolts, or other round sections cut from trees (including chips from roundwood).

Sapling.—A live tree between 1.0 and 5.0 inches d.b.h.

Sapling removals.—Net volume in saplings harvested for roundwood products.

Saw-log portion.—That portion of the central stem of sawtimber trees between the stump and the saw-log top.

Saw-log top.—The point on the central stem of sawtimber trees above which a saw log cannot be produced. The minimum saw-log top is 7.0 inches d.o.b. for softwoods and 9.0 inches d.o.b. for hardwoods.

Sawtimber removals.—The net volume in the merchantable central stem of sawtimber trees harvested for roundwood products. (Note: Includes the saw-log and upper-stem portions of sawtimber trees.)

Sawtimber tree.—A growing-stock tree containing at least a 12-foot saw log or two noncontiguous saw logs 8 feet or longer, and meeting regional specifications for freedom from defect. Softwoods must be at least 9.0 inches d.b.h. and hardwoods must be at least 11.0 inches d.b.h.

Secondary wood-using mills.—Mills receiving primary wood products for manufacture into secondary wood products (furniture, cabinets, etc.).

Softwoods.—Coniferous trees, usually evergreen, having needles or scale-like leaves.

Tree.—A woody plant usually having one or more perennial stems, a more or less definitely formed crown of foliage, and a height of at least 12 feet at maturity.

Timberland.—Forest land that is producing, or is capable of producing, in excess of 20 cubic feet per acre per year of industrial roundwood products under natural conditions, is not withdrawn from timber utilization by statute or administrative regulation, and is not associated with urban or rural development. In this report, all forest land removals were assumed to be timberland removals.

Upper stem portion.—That portion of the central stem of sawtimber trees between the saw-log top and the minimum top diameter of 4.0 inches outside bark or to the point where the central stem breaks into limbs.

Wood residues.—Includes woody material (bark, coarse, fine, etc.) generated at primary wood-using mills, woody material (sawdust, scrap, trim, wood flour, etc.) generated at secondary wood-using plants, and waste secondary wood products.

COMMON AND SCIENTIFIC NAMES OF TREE SPECIES MENTIONED

SOFTWOODS

Cedar
- Eastern redcedar ..... *Juniperus virginiana*

Pine
- Austrian pine ..... *Pinus nigra*
- Scotch pine ..... *Pinus sylvestris*

HARDWOODS

Ash
- White ash ..... *Fraxinus americana*
- Green ash ..... *Fraxinus pennsylvanica*

Birch
- River birch ..... *Betula nigra*

Boxelder ..... *Acer negundo*

Catalpa
- Northern catalpa ..... *Catalpa speciosa*

Cottonwood
- Eastern cottonwood ..... *Populus deltoides*

Elm
- American elm ..... *Ulmus americana*
- Siberian elm ..... *Ulmus pumila*
- Slippery elm ..... *Ulmus rubra*

Hackberry ..... *Celtis occidentalis*

Hickory
- Bitternut hickory ..... *Carya cordiformis*
- Shellbark hickory ..... *Carya laciniosa*
- Shagbark hickory ..... *Carya ovata*
- Black hickory ..... *Carya texana*
- Mockernut hickory ..... *Carya tomentosa*

Locust
- Black locust ..... *Robinia pseudoacacia*
- Honeylocust ..... *Gleditsia triacanthos*

Maple
- Silver maple ..... *Acer saccharinum*

Mulberry
- Red mulberry ..... *Morus rubra*

Oak
- Red oak
  - Northern red oak ..... *Quercus rubra*
  - Black oak ..... *Quercus velutina*
  - Blackjack oak ..... *Quercus marilandica*
  - Shumard oak ..... *Quercus shumardii*
  - Shingle oak ..... *Quercus imbricaria*
  - Pin oak ..... *Quercus palustris*
- White oak
  - White oak ..... *Quercus alba*
  - Bur oak ..... *Quercus macrocarpa*
  - Chinkapin oak ..... *Quercus muehlenbergii*
  - Post oak ..... *Quercus stellata*

Pecan ..... *Carya Illinoensis*

Sassafras ..... *Sassafras albidum*

Walnut
- Black walnut ..... *Juglans nigra*

Willow
- Black willow ..... *Salix nigra*

Noncommercial species
- Apple ..... *Malus* spp.
- Osage-orange ..... *Maclura pomifera*

TABLE TITLES

Table 1.—Household possession and use of wood-burning facilities by Forest Survey Unit, Kansas, 1994

Table 2.—Residential fuelwood consumption by reason for burning and Forest Survey Unit, Kansas, 1994

Table 3.—Residential fuelwood consumption by type of wood-burning facility and Forest Survey Unit, Kansas, 1994

Table 4.—Residential fuelwood consumption by type of wood-burning facility and reason for burning, Kansas, 1994

Table 5.—Residential fuelwood consumption by reason for burning and year first burned wood, Kansas, 1994

Table 6.—Residential fuelwood consumption by place of consumption, Kansas, 1994

Table 7.—Residential fuelwood consumption by type of fuelwood, Kansas, 1994

Table 8.—Residential fuelwood consumption by species group and Forest Survey Unit, Kansas, 1994

Table 9.—Residential fuelwood consumption by method of procurement and Forest Survey Unit, Kansas, 1994

Table 10.—Residential consumption of purchased fuelwood by size of wood, Kansas, 1994

Table 11.—Residential fuelwood production by source of material and Forest Survey Unit, Kansas, 1994

Table 12.—Residential fuelwood production from roundwood by species group and source of material, Kansas, 1994

Table 13.—Residential fuelwood production from roundwood by species group and Forest Survey Unit, Kansas, 1994

Table 14.—Residential fuelwood production from roundwood by species group and ownership class, Kansas, 1994

Table 15.—Residential fuelwood production from roundwood by source of material and ownership class, Kansas, 1994

Table 16.—Distribution of timber removals associated with residential fuelwood production by Forest Survey Unit, Kansas, 1994

Table 17.—Distribution of timber removals associated with residential fuelwood production by species group, Kansas, 1994

Table 1. -- Household possession and use of wood-burning facilities by Forest Survey Unit, Kansas, 1994

(In number of households)

Forest Survey Unit	Households	Households with wood-burning facilities	Households burning wood in 1994	Households planning to burn wood in 1995	Households planning to install wood-burning facilities
Northeastern	420,795	174,937	112,482	125,684	6,277
Southeastern	142,752	51,215	36,989	38,411	4,268
Western	381,179	142,608	109,676	116,727	11,194
Total	944,726	368,760	259,147	280,822	21,738

Table 2. -- Residential fuelwood consumption by reason for burning and Forest Survey Unit, Kansas, 1994

Forest Survey Unit and reason for burning	Number of households	Volume (Cords)	Average (Cords/ household)
Northeastern			
Pleasure	59,547	18,134	0.30
Primary heat	12,679	83,947	6.62
Secondary heat	40,256	50,044	1.24
Total	112,482	152,125	1.35
Southeastern			
Pleasure	6,402	4,077	0.64
Primary heat	12,804	36,141	2.82
Secondary heat	17,783	32,100	1.81
Total	36,989	72,318	1.96
Western			
Pleasure	51,449	34,409	0.67
Primary heat	12,679	45,216	3.57
Secondary heat	45,548	63,788	1.40
Total	109,676	143,414	1.31
All Units			
Pleasure	117,399	56,619	0.48
Primary heat	38,161	165,304	4.33
Secondary heat	103,587	145,933	1.41
Total	259,147	367,857	1.42

Table 3. -- Residential fuelwood consumption by type of wood-burning facility and Forest Survey Unit, Kansas, 1994

Forest Survey Unit and wood-burning facility	Number of households	Volume (Cords)	Average (Cords/ household)
Northeastern			
Stove	22,324	93,684	4.20
Furnace	2,134	5,200	2.44
Fireplace insert	18,705	9,286	0.50
Fireplace	65,113	42,655	0.66
Fire pit	3,494	766	0.22
Combinations	711	533	0.75
Total	112,482	152,125	1.35
Southeastern			
Stove	15,649	36,361	2.32
Furnace	1,423	2,490	1.75
Fireplace insert	6,402	10,826	1.69
Fireplace	12,804	22,175	1.73
Fire pit	711	468	0.66
Total	36,989	72,318	1.96
Western			
Stove	19,667	48,327	2.46
Furnace	711	2,404	3.38
Fireplace insert	14,039	26,418	1.88
Fireplace	69,631	59,172	0.85
Fire pit	2,071	62	0.03
Combinations	3,557	7,031	1.98
Total	109,676	143,414	1.31
All Units			
Stove	57,640	178,371	3.09
Furnace	4,268	10,093	2.36
Fireplace insert	39,146	46,529	1.19
Fireplace	147,548	124,002	0.84
Fire pit	6,277	1,296	0.21
Combinations	4,268	7,565	1.77
Total	259,147	367,857	1.42

Table 4. -- Residential fuelwood consumption by type of wood-burning facility and reason for burning, Kansas, 1994

Type of facility	All reasons		Reason for burning					
			Primary heat		Secondary heat		Pleasure	
	Number of households	Volume (Cords)	Number of households	Volume (Cords)	Number of households	Volume (Cords)	Number of households	Volume (Cords)
Stove	57,640	178,371	25,357	133,499	26,006	41,264	6,277	3,607
Furnace	4,268	10,093	4,268	10,093	-	-	-	-
Fireplace insert	39,146	46,529	3,557	5,074	23,098	35,196	12,491	6,259
Fireplace	147,548	124,002	3,557	10,769	51,637	67,776	92,354	45,457
Fire pit	6,277	1,296	-	-	-	-	6,277	1,296
Combinations	4,268	7,565	1,423	5,868	2,845	1,697	-	-
Total	259,147	367,857	38,161	165,304	103,587	145,933	117,399	56,619

Table 5. -- Residential fuelwood consumption by reason for burning and year first burned wood, Kansas, 1994

Reason for burning and year first burned wood	Number of households	Volume (Cords)	Average (Cords/ household)
Pleasure			
Last year	28,414	11,093	0.39
2 years ago	10,420	4,365	0.42
3 years ago	2,134	1,245	0.58
4 years ago	711	71	0.10
5 or more years ago	75,720	39,846	0.53
Total	117,399	56,619	0.48
Primary heat			
Last year	2,134	4,922	2.31
2 years ago	2,134	10,001	4.69
3 years ago	711	2,404	3.38
4 years ago	711	548	0.77
5 or more years ago	32,471	147,429	4.54
Total	38,161	165,304	4.33
Secondary heat			
Last year	14,688	14,388	0.98
2 years ago	12,491	16,884	1.35
3 years ago	11,131	13,239	1.19
4 years ago	4,854	10,630	2.19
5 or more years ago	60,423	90,792	1.50
Total	103,587	145,933	1.41
All reasons			
Last year	45,235	30,403	0.67
2 years ago	25,045	31,250	1.25
3 years ago	13,976	16,888	1.21
4 years ago	6,277	11,249	1.79
5 or more years ago	168,614	278,067	1.65
Total	259,147	367,857	1.42

Table 6. -- Residential fuelwood consumption by place of consumption, Kansas, 1994

Forest Survey Unit and place of consumption	Number of households	Volume consumed					Average (Cords/ household)
		Primary residence (Cords)	Secondary residence (Cords)	Other building (Cords)	Other[1] (Cords)	Total consumption (Cords)	
Northeastern							
Primary residence	111,059	151,413	-	-	-	151,413	1.36
Secondary residence	711	-	356	-	-	356	0.50
Other[1]	711	-	-	-	356	356	0.50
Total	112,482	151,413	356	-	356	152,125	1.35
Southeastern							
Primary residence	34,855	69,173	-	-	-	69,173	1.98
Other building	1,423	-	-	2,678	-	2,678	1.88
Other[1]	711	-	-	-	468	468	0.66
Total	36,989	69,173	-	2,678	468	72,318	1.96
Western							
Primary residence	104,759	134,243	-	-	-	134,243	1.28
Secondary residence	711	-	822	-	-	822	1.16
Other building	1,423	-	-	2,952	-	2,952	2.07
Other[1]	2,071	-	-	-	62	62	0.03
Combination	711	4,268	-	1,067	-	5,335	7.50
Total	109,676	138,511	822	4,019	62	143,414	1.31
All units							
Primary residence	250,673	354,829	-	-	-	354,829	1.42
Secondary residence	1,423	-	1,177	-	-	1,177	0.83
Other building	2,845	-	-	5,630	-	5,630	1.98
Other[1]	3,494	-	-	-	886	886	0.25
Combination	711	4,268	-	1,067	-	5,335	7.50
Total	259,147	359,097	1,177	6,696	886	367,857	1.42

[1] Consumed at campsites.

Table 7. -- Residential fuelwood consumption by type of fuelwood, Kansas, 1994

Forest Survey Unit and type of fuelwood	Number of households	Volume consumed			Average (Cords/ household)
		Roundwood (Cords)	Wood residues (Cords)	Total consumption (Cords)	
Northeastern					
Roundwood	105,556	138,180	-	138,180	1.31
Wood residues	2,071	-	1,036	1,036	0.50
Combination	4,854	9,486	3,423	12,908	2.66
Total	112,482	147,666	4,458	152,125	1.35
Southeastern					
Roundwood	32,721	66,443	-	66,443	2.03
Wood residues	1,423	-	2,602	2,602	1.83
Combination	2,845	2,378	896	3,274	1.15
Total	36,989	68,820	3,498	72,318	1.96
Western					
Roundwood	104,759	138,794	-	138,794	1.32
Wood residues	711	-	711	711	1.00
Combination	4,205	3,246	662	3,908	0.93
Total	109,676	142,040	1,373	143,414	1.31
All Units					
Roundwood	243,036	343,417	-	343,417	1.41
Wood residues	4,205	-	4,349	4,349	1.03
Combination	11,905	15,110	4,981	20,091	1.69
Total	259,147	358,527	9,330	367,857	1.42

Table 8. -- Residential fuelwood consumption by species group and Forest Survey Unit, Kansas, 1994

(In cords)

Species group	All Units	Forest Survey Unit		
		Northeastern	Southeastern	Western
Softwoods				
Cedar	1,935	719	-	1,216
Pine	973	-	533	439
Total softwoods	2,908	719	533	1,655
Hardwoods				
Maple	2,375	-	-	2,375
Birch	825	-	-	825
Hickory	2,366	1,540	-	825
Pecan	1,292	-	1,292	-
Catalpa	504	-	-	504
Hackberry	27,724	13,851	9,403	4,471
Ash	23,294	6,489	6,024	10,780
Locust	2,034	708	1,326	-
Walnut	2,711	-	1,023	1,688
Osage-orange	71,537	18,241	38,542	14,753
Apple[1]	932	462	-	470
Mulberry	3,797	-	2,028	1,769
Cottonwood	24,566	963	-	23,603
Oak	156,727	87,502	8,956	60,269
Willow	44	-	-	44
Sassafras	101	-	101	-
Elm	44,122	21,649	3,090	19,383
Total hardwoods	364,949	151,405	71,785	141,759
All species	367,857	152,125	72,318	143,414

[1] Includes apricot, pear, and Russian olive.

Table 9. -- Residential fuelwood consumption by method of procurement and Forest Survey Unit, Kansas, 1994

Forest Survey Unit and procurement method	Number of households	Volume purchased (Cords)	Volume cut (Cords)	Volume other[1] (Cords)	Total consumption (Cords)	Average (Cords/ household)
Northeastern						
Buy[1]	59,547	72,816	-	7,426	80,241	1.35
Cut	41,155	-	54,358	-	54,358	1.32
Cut and buy[1]	11,780	1,998	12,105	3,423	17,525	1.49
Total	112,482	74,814	66,463	10,848	152,125	1.35
Southeastern						
Buy[1]	15,649	22,153	-	2,707	24,861	1.59
Cut	17,783	-	36,359	-	36,359	2.04
Cut and buy[1]	3,557	1,931	4,186	4,981	11,099	3.12
Total	36,989	24,085	40,545	7,689	72,318	1.96
Western						
Buy[1]	52,161	36,227	-	3,158	39,385	0.76
Cut	42,242	-	84,505	-	84,505	2.00
Cut and buy[1]	15,274	11,574	7,312	638	19,524	1.28
Total	109,676	47,801	91,816	3,796	143,414	1.31
All Units						
Buy[1]	127,357	131,197	-	13,291	144,488	1.13
Cut	101,179	-	175,221	-	175,221	1.73
Cut and buy[1]	30,610	15,503	23,603	9,042	48,148	1.57
Total	259,147	146,699	198,824	22,333	367,857	1.42

[1] Includes gift wood, free wood, leftover wood, etc.

Table 10. -- Residential consumption of purchased fuelwood by size of wood, Kansas, 1994

Size of wood purchased	Number of households	Volume (Cords)	Average (Cords/ household)
16 inch	70,029	87,526	1.25
24 inch	37,536	29,801	0.79
4 foot	2,134	1,243	0.58
8 foot	711	2,134	3.00
Random length residues	3,494	1,334	0.38
Random length roundwood	18,893	24,661	1.31
Total purchased	132,797	146,699	1.10

Table 11. -- Residential fuelwood production by source of material and Forest Survey Unit, Kansas, 1994

(In cords)

		Source of material					
					Forest land		
Forest Survey Unit	All sources	Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Standing live trees	Harvest residues	Dead trees
Northeastern	133,132	7,160	5,990	75,780	7,084	1,315	35,803
Southeastern	94,723	1,414	21,849	27,303	19,986	307	23,863
Western	100,701	10,928	29,327	22,804	15,510	-	22,132
Total	328,556	19,502	57,167	125,888	42,580	1,622	81,798

Table 12. -- Residential fuelwood production from roundwood by species group and source of material, Kansas, 1994

(In cords)

Species group	All sources	Source of material					
					Forest land		
		Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Standing live trees	Harvest residues	Dead trees
Softwoods							
Cedar	2,093	536	29	107	658	9	754
Pine	670	-	-	-	-	-	670
Total softwoods	2,763	536	29	107	658	9	1,424
Hardwoods							
Maple	2,869	62	623	801	1,384	-	-
Boxelder	2,963	517	423	2,023	-	-	-
Birch	414	-	-	-	-	-	414
Hickory	2,046	226	49	1,295	30	11	434
Pecan	1,167	5	689	472	-	-	-
Catalpa	876	-	-	-	-	-	876
Hackberry	12,618	447	2,681	2,691	609	6	6,185
Ash	21,321	998	1,244	6,081	4,542	264	8,191
Locust	2,679	153	300	790	-	-	1,435
Walnut	7,481	1,164	3,010	649	661	36	1,960
Osage-orange	115,542	3,272	20,721	66,846	9,616	941	14,146
Apple[1]	2,745	1,915	458	365	-	-	7
Mulberry	3,926	1,105	1,770	870	180	-	1
Cottonwood	33,344	2,477	6,502	8,573	12,002	-	3,790
Oak	64,867	669	3,068	21,279	9,064	354	30,432
Willow	45	1	6	1	3	-	35
Elm	50,889	5,956	15,594	13,044	3,830	-	12,466
Total hardwoods	325,793	18,966	57,138	125,780	41,922	1,613	80,373
All species	328,556	19,502	57,167	125,888	42,580	1,622	81,798

[1] Includes apricot, pear, and Russian olive.

Table 13. -- Residential fuelwood production from roundwood by species group and Forest Survey Unit, Kansas, 1994

(In cords)

Species group	All Units	Forest Survey Unit		
		Northeastern	Southeastern	Western
Softwoods				
Cedar	2,093	752	465	876
Pine	670	-	533	137
Total softwoods	2,763	752	998	1,013
Hardwoods				
Maple	2,869	-	711	2,158
Boxelder	2,963	2,963	-	-
Birch	414	-	414	-
Hickory	2,046	1,560	485	-
Pecan	1,167	-	1,167	-
Catalpa	876	-	-	876
Hackberry	12,618	7,540	4,927	151
Ash	21,321	8,462	6,590	6,270
Locust	2,679	874	1,805	-
Walnut	7,481	206	2,657	4,617
Osage-orange	115,542	62,617	38,865	14,060
Apple[1]	2,745	468	371	1,906
Mulberry	3,926	2	2,220	1,703
Cottonwood	33,344	418	484	32,442
Oak	64,867	27,238	22,240	15,389
Willow	45	-	-	45
Elm	50,889	20,031	10,788	20,071
Total hardwoods	325,793	132,380	93,725	99,688
All species	328,556	133,132	94,723	100,701

[1] Includes apricot, pear, and Russian olive.

Table 14. -- Residential fuelwood production from roundwood by species group and ownership class, Kansas, 1994

(In cords)

Species group	All ownerships	Ownership class			
		Other federal	State	County/ municipal	Other private
Softwoods					
Cedar	2,093	-	-	-	2,093
Pine	670	-	137	-	533
Total softwoods	2,763	-	137	-	2,626
Hardwoods					
Maple	2,869	-	4	-	2,865
Boxelder	2,963	-	-	-	2,963
Birch	414	-	-	-	414
Hickory	2,046	-	-	-	2,046
Pecan	1,167	-	-	-	1,167
Catalpa	876	-	-	-	876
Hackberry	12,618	-	42	-	12,576
Ash	21,321	3	49	-	21,269
Locust	2,679	-	22	-	2,657
Walnut	7,481	-	48	-	7,433
Osage-orange	115,542	-	195	-	115,348
Apple[1]	2,745	-	4	-	2,741
Mulberry	3,926	-	9	32	3,885
Cottonwood	33,344	-	629	-	32,715
Oak	64,867	27	121	-	64,719
Willow	45	-	*	-	45
Elm	50,889	3	702	1,455	48,729
Total hardwoods	325,793	34	1,824	1,487	322,449
All species	328,556	34	1,961	1,487	325,075

[1] Includes apricot, pear, and Russian olive.

* Less than one-half cord.

Table 15. -- Residential fuelwood production from roundwood by source of material and ownership class, Kansas, 1994

(In cords)

Ownership class	All sources	Source of material					
		Cities and villages	Windbreaks, fencerows, rural yards	Pasture and cropland	Forest land		
					Standing live trees	Harvest residues	Dead trees
Other federal	34	-	-	-	-	-	34
State	1,961	-	311	-	-	-	1,650
County/municipal	1,487	1,423	64	-	-	-	-
Other private	325,075	18,079	56,792	125,888	42,580	1,622	80,114
Total	328,556	19,502	57,167	125,888	42,580	1,622	81,798

Table 16. -- Distribution of timber removals associated with residential fuelwood production by Forest Survey Unit, Kansas, 1994

(In thousand cubic feet)

Forest Survey Unit	Timberland removals								Total timberland removals	Non-timberland removals	Total Removals
	Growing-stock removals			Non-growing-stock removals							
	Sawtimber	Poletimber	Total	Limbwood	Sapling	Cull trees	Dead trees	Total			
Northeastern	117	93	209	145	54	178	2,509	2,885	3,094	6,225	9,319
Southeastern	187	150	337	260	145	678	1,671	2,754	3,091	3,540	6,631
Western	262	213	475	185	116	310	1,549	2,160	2,635	4,414	7,049
Total	565	456	1,021	590	315	1,166	5,729	7,799	8,820	14,179	22,999

Table 17. -- Distribution of timber removals associated with residential fuelwood production by species group, Kansas, 1994

(In thousand cubic feet)

Species group	Timberland removals										
	Growing-stock removals			Non-growing-stock removals					Total timberland removals	Non-timberland removals	Total Removals
	Sawtimber	Poletimber	Total	Limbwood	Sapling	Cull trees	Dead trees	Total			
Softwoods											
Cedar	11	9	21	8	5	13	53	79	99	47	146
Pine	-	-	-	-	-	-	47	47	47	-	47
Total softwoods	11	9	21	8	5	13	100	126	146	47	193
Hardwoods											
Maple	24	19	43	16	10	27	-	54	97	104	201
Boxelder	-	-	-	-	-	-	-	-	-	207	207
Birch	-	-	-	-	-	-	29	29	29	-	29
Hickory	1	*	1	1	*	1	30	32	33	110	143
Pecan	-	-	-	-	-	-	-	-	-	82	82
Catalpa	-	-	-	-	-	-	61	61	61	-	61
Hackberry	11	9	19	8	5	12	433	457	476	407	883
Ash	82	65	147	66	34	89	574	763	910	583	1,492
Locust	-	-	-	-	-	-	100	100	100	87	187
Walnut	*	*	1	18	*	30	137	185	186	338	524
Osage-orange	-	-	-	158	72	507	992	1,729	1,729	6,359	8,088
Apple[1]	-	-	-	-	-	-	*	*	*	192	192
Mulberry	3	3	6	2	1	4	*	7	13	262	275
Cottonwood	206	168	374	143	90	233	265	731	1,105	1,229	2,334
Oak	161	129	290	124	68	177	2,131	2,500	2,790	1,751	4,541
Willow	*	*	*	*	*	*	2	3	3	1	3
Elm	66	54	119	46	29	74	873	1,021	1,141	2,422	3,562
Total hardwoods	553	447	1,000	581	310	1,153	5,629	7,673	8,674	14,132	22,806
All species	565	456	1,021	590	315	1,166	5,729	7,799	8,820	14,179	22,999

[1] Includes apricot, pear, and Russian olive.

* Less than 500 cubic feet.

The United States Department of Agriculture (USDA) prohibits discrimination in its programs on the basis of race, color, national origin, sex, religion, age, disability, political beliefs, and marital or familial status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means of communication of program information (braille, large print, audiotape, etc.) should contact the USDA Office of Communications at (202) 720-2791.

To file a complaint, write the Secretary of Agriculture, U.S. Department of Agriculture, Washington, DC 20250, or call 202-720-7327 (voice), or 202-720-1127 (TDD). USDA is an equal employment opportunity employer.

Printed on recycled, recyclable paper.

May, Dennis M.
1996. **Residential fuelwood consumption and production in Kansas, 1994.** Resour. Bull. NC-169. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 25 p.

Reports findings of the latest survey of residential fuelwood consumption and production in Kansas. Topics examined include the geographic distribution of residential fuelwood consumption and production within the State; the species of trees used for residential fuelwood; the types of wood-burning facilities used; the reasons for burning fuelwood; and the land, ownership, and tree classes from which fuelwood was produced.

KEY WORDS: Fireplace, firewood, harvest, households, roundwood, wood stove.

Our job at the North Central Forest Experiment Station is discovering and creating new knowledge and technology in the field of natural resources and conveying this information to the people who can use it. As a new generation of forests emerges in our region, managers are confronted with two unique challenges: (1) Dealing with the great diversity in composition, quality, and ownership of the forests, and (2) Reconciling the conflicting demands of the people who use them. Helping the forest manager meet these challenges while protecting the environment is what research at North Central is all about.

☆U.S. GOVERNMENT PRINTING OFFICE: 1996 - 756-751/20183

MINNESOTA
MAJOR FOREST TYPES
1990

MANITOBA

CANADA

ONTARIO

LAKE SUPERIOR

NORTH DAKOTA

SOUTH DAKOTA

WISCONSIN

IOWA

LAKE OF THE WOODS

KITTSON

ROSEAU

MARSHALL

PENNINGTON

RED LAKE

POLK

NORMAN

MAHNOMEN

CLEARWATER

BELTRAMI

KOOCHICHING

UPPER RED LAKE

LOWER RED LAKE

ITASCA

LEECH LAKE

HUBBARD

CASS

CLAY

BECKER

WADENA

CROW WING

AITKIN

SAINT LOUIS

LAKE

COOK

CARLTON

WILKIN

OTTER TAIL

MILLE LACS LAKE

PINE

TODD

MORRISON

MILLE LACS

KANABEC

TRAVERSE

GRANT

DOUGLAS

BENTON

ISANTI

CHISAGO

STEVENS

POPE

STEARNS

STERLING

BIG STONE

SWIFT

KANDIYOHI

MEEKER

WRIGHT

ANOKA

WASHINGTON

RAMSEY

HENNEPIN

LAC QUI PARLE

CHIPPEWA

MC LEOD

CARVER

YELLOW MEDICINE

RENVILLE

SCOTT

DAKOTA

SIBLEY

LINCOLN

LYON

REDWOOD

NICOLLET

LE SUEUR

RICE

GOODHUE

WABASHA

BROWN

PIPESTONE

MURRAY

COTTONWOOD

WATONWAN

BLUE EARTH

WASECA

STEELE

DODGE

OLMSTED

WINONA

ROCK

NOBLES

JACKSON

MARTIN

FARIBAULT

FREEBORN

MOWER

FILLMORE

HOUSTON

Pine

Spruce-Fir

Oak

Elm-Ash-Cottonwood

Maple-Basswood

Aspen-Birch

Unproductive Forest Land

Non-Forest Land

Water

0 10 20 30 40 miles

0 10 20 30 40 50 60 kilometers

Compilation procedure:
Forest types were interpreted using standard forest inventory procedures on the most recently available aerial photography for each county in Minnesota at 1:58,000 and 1:40,000 scales. The data were digitized, then transferred to a computer that displayed the forest type of each photo plot as a pixel, representing approximately 190 acres in area, on the 1:1,000,000 scale map.

Compiled by: Elizabeth C. Collins, Forest Service, George W. Deegan, Minnesota DNR, Patrick D. Miles, Forest Service, and Kevin k. Nimerfro, Forest Service.

Prepared by: Horizons, Inc.

Forest Inventory and Analysis Program
North Central Forest Experiment Station
Forest Service
U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, Minnesota 55108

Resource Assessment Unit
Department of Forestry
Minnesota Department of Natural Resources
2002 Airport Road
Grand Rapids, Minnesota 55744